



DEPARTMENT OF  
PETROLEUM RESOURCES  
...Petroleum Regulatory Agency Of Nigeria

Applicable to all Oil & Gas Operators

GUIDELINES FOR THE IMPLEMENTATION OF RISK BASED INSPECTION IN  
THE NIGERIAN OIL AND GAS INDUSTRY

Code: DPR Guide 0022 - 2020

Revision Date: 1st August 2020

# GUIDELINES FOR THE IMPLEMENTATION OF RISK BASED INSPECTION IN THE NIGERIAN OIL AND GAS INDUSTRY

*ISSUED BY*

**DEPARTMENT OF PETROLEUM RESOURCES**

**2020**

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## 1. SCOPE

This guideline sets out the procedure for the implementation of the directives of the Director of Petroleum Resources with respect to Risk Based Inspection (RBI) on Fixed (Pressure) Equipment in the Nigerian Oil and Gas Industry pursuant to Regulation 15 of the Mineral Oils (Safety) Regulations, 1963 (MOSR) which requires that the testing and inspection of such equipment be carried out to the Director’s satisfaction. This document also explains the procedure and requirements of various directives and approvals being issued pursuant to Regulations 44 and 45 of the Petroleum (Drilling and Production) Regulations, 1969 and other applicable Regulations/Laws regarding RBI implementation in the industry. This guideline is the updated version of “Guidelines Concerning Implementation and Use of Risk Based Inspections in the Nigerian Petroleum Industry, 2006”.

## 2. DEFINITION & PURPOSE

RBI is a process which aims to assess the risks of operating an equipment/device in a facility, then prioritizes and plans the inspection type and the intervals based on these risks. Risk analysis is a means to identify focal areas in order to meet the acceptance criteria for risk and to enhance the safety level in activities. Risk analysis provides knowledge concerning risk(s) connected with activities and constitutes a basis for the decision-making process so as to plan and implement activities in accordance with the intent of the applicable legislation and with an Operator’s own safety requirements. Whereas the MOSR and other statutory guidance prescribes statutory maximum inspection intervals for various groups of equipment such as pressure vessels, boilers, tanks and pressure relief valves, the RBI approach is risk-based as the terminology implies. The maximum inspection intervals generated from RBI assessments generally differ from that which is prescribed. The Department currently reviews requests from Operators wishing to adopt

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the RBI approach and approves same if the implementation process is in accordance with the intent of the applicable legislations and conforms to international standards and best practices.

This document stipulates the procedures required prior to obtaining an RBI approval from the Department and the expectations following the approval on both existing and new facilities. The RBI approach is only an alternative and is not intended to replace the prescriptive approach as provided in the MOSR. This guideline is to ensure that analysis and programmes are applied correctly, based on sound engineering and scientific judgments principles and such that the economic and operational benefit of the RBI are realized together with enhanced safety.

## 2.1 Definition of Terms

The following terms defined in this section describes its usage in this guideline:

- i. **RBI:** RBI is a process which aims to assess the risks of operating an equipment/device in a facility, then prioritizes and plans the inspection type and the intervals based on these risks.
- ii. **RBI Methodology:** It is a developed strategy used to implement the entire RBI process and cycle.
- iii. **RBI Assessment:** The systematic application of RBI methodology on an equipment/device or group of equipment/devices to determine the RBI results.
- iv. **RBI Reassessment:** A review of the assessment performed on an equipment/device that has been previously RBI-assessed.
- v. **RBI Methodology Approval:** The Approval letter issued to an Operator by DPR when a submitted proposed RBI Methodology and Processes have been evaluated and deemed satisfactory.

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- vi. **RBI Final Approval:** The Approval letter issued to an Operator after RBI results have been generated following a satisfactory RBI assessment for a facility under a given scope.
- vii. **RBI Validation:** It is the method of evaluating the extent of compliance by an Operator with the RBI Guidelines and Processes especially after the receipt of RBI Final Approval.
- viii. **Technical Audit:** It is the assessment of the various components and value chain of RBI application which comprises but not limited to Tools, Software, Record-Keeping, Methodology, Process, Database and People.
- ix. **Technical Workshop:** It is an organised session which comprises relevant Subject Matter Experts and Regulator, set up to evaluate RBI process/tools. e.g. Equipment Risk Assessment (RBI) Workshop, RBI Methodology/Software Modification/Upgrade Session, etc.

### 3. APPLICATION & APPROVAL PROCEDURE

#### 3.1 RBI Application Overview

The Department approves and validates the RBI program for Operators in the Oil and Gas Industry through a technical audit of the various components and the entire chain of the RBI process, from design through the development of RBI tools and strategy, gathering of baseline information for inspection decisions, participation in workshops for determining criticality and inspection frequency, witnessing equipment inspections, ensuring that inspection data are utilized for updating the RBI process cycle and validating an upgrade of the RBI tool. The role of the Department in the RBI process is

shown in figure 3.1 below:

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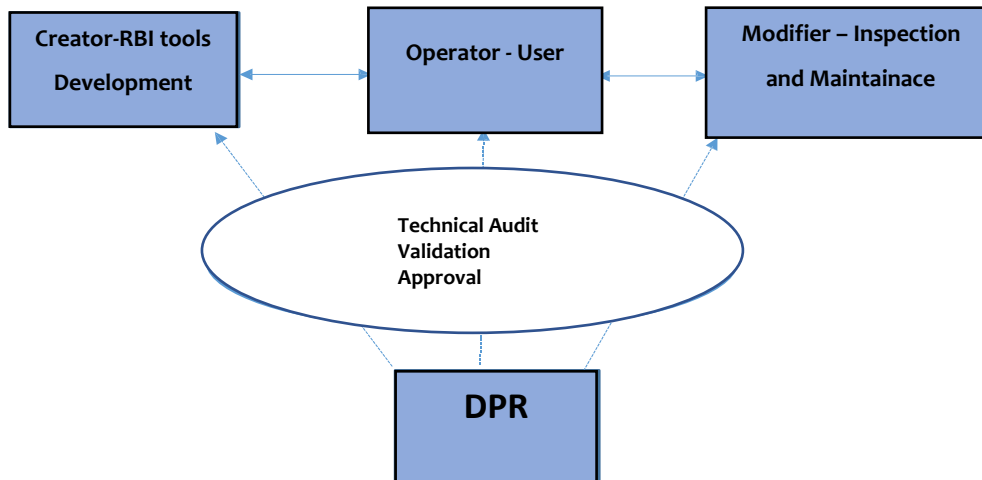


Figure 3.1: Role of DPR in the RBI Process

### 3.2 Document Submission:

Operator(s) intending to use RBI approach for equipment/devices inspection in any of their facilities shall submit an application or request for the purpose. The RBI application proposal shall contain, but not be limited to the following:

- i. Clear definitions and objectives (including roles and responsibilities of contractors and individuals to be involved in the RBI implementation processes)
- ii. Scope of the implementation being requested.
- iii. RBI assessment basis, processes and assumptions (including the risk assessment decision matrix, risk assessment criteria, approval levels within the organisation, etc.).
- iv. RBI assessment tool (application software) description. Note: Third-party RBI assessment tools approved by DPR may be adopted for deployment by an operator in the RBI methodology.
- v. Other inspection tools and software aiding the RBI tool.



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- vi. Equipment/Devices inspection strategies and methodologies (including Management of Change, Deviations and Non-conformances resolution procedures).
- vii. RBI documentation procedure.

### **3.3 RBI Methodology Demonstration**

A workshop shall be arranged with the DPR to evaluate the submission and to offer an opportunity for the Operator to demonstrate the capacity to deploy the RBI approach in line with the intent of the applicable legislation(s) and international best practices/standards and sustain its implementation. The RBI methodology and processes shall conform to and meet the minimum expectations set forth by the current versions of American Petroleum Institute (API) Recommended Practice (RP) - API RP 580, API RP 581 and/or any other relevant internationally recognised systems and processes for RBI. To apply RBI on equipment/device(s) in existing facilities/assets, an Operator would in addition, be required to demonstrate compliance with the prescriptive inspection and maintenance regime being implemented to the satisfaction of the Department. Also, the Operator shall ensure that the Department's representative(s) are duly familiar with all the processes and software to be deployed. The review of the submission and the outcome of the workshop, if found satisfactory, shall form the basis for issuing an approval-in-principle to an Operator for the implementation of an RBI approach.

The decision for a submission on RBI methodology to be approved or otherwise will largely depend on the description of risk analysis to be carried out or updated during the RBI phases and cycle or to which the consent/approval is applicable. Also, the factors contributing to final risk assessment which include but not limited to the following are considered: -

- i. Team members performing the assessments and their qualifications
- ii. Reassessment interval

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- iii. Risk acceptance criteria
- iv. Factors used to determine risk
- v. Assumptions made during assessment
- vi. Risk assessment results (unmitigated risk level)
- vii. Follow-up mitigation strategy
- viii. Mitigated risk level

In addition to the above demonstration, an Operator wishing to implement an RBI program must have the resources and structure to implement and sustain the program. This will include the continuous involvement of experienced corrosion, materials, inspection, safety, maintenance and process engineers/technologist in the process. The DPR shall be informed if an Operator intends to alter the acceptance criteria and safety objectives for risks in the activities, failing which the DPR may choose to invalidate the approval process.

### 3.3.1 Safety Objectives

Operators implementing RBI methodology and risk assessment shall define safety objectives for their activities. To ensure that the planning, maintaining and enhancement of safety in the activities become a dynamic and forward-looking process, the Operator is required to express his safety objective as an ideal safety level. The safety objectives shall reflect the requirement of all applicable Regulations with regards to safety of people, assets, the environment and cost.

Depending on the activity, the Operator's safety objectives may be expressed as long-term and short-term objectives and shall be used to determine preventive safety measures based on knowledge obtained through a risk analysis. This shall be used for the enhancement of safety in the activities and shall form the basis for revision of the Operator's acceptance criteria.

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### 3.3.2 Definition of Acceptance Criteria (AC)

The Acceptance Criteria (AC) expresses the level of risk deemed acceptable by an Operator for a given period or phase of activities. It expresses a standpoint regarding risk connected to loss of lives, injury, property damage, production down time and damage to the environment. It must reflect the safety objectives and peculiar characteristics of the activities. The following amongst others shall form the basis for defining Acceptance Criteria (AC):

- i. Safety legislation.
- ii. Recognized industry standards.
- iii. Applicable risk reduction measures.
- iv. Prior knowledge of accidental events and their effects.
- v. Experience and sound engineering judgment.
- vi. Social perception and acceptability

Limits for Quantitative Acceptance Criteria shall be clearly defined for their application and all data used shall be documented. Due to uncertainty in expressing risk in quantitative terms, the way quantitative AC are to be used shall be specified and efforts shall be made to reduce subjectivity to the barest minimum. Similarly, conditions for Qualitative Acceptance Criteria shall be defined. An Operator is expected to revise the AC over time to take account inter alia of experience, additional information, possible changes in the activities and technological advancement. Furthermore, the achievement of safety objectives may entail an actual reduction of risk in the activities, and thus provide basis for a revised definition of acceptance criteria.

### 3.4 RBI Assessment for Facilities

The issued approval-in-principle grants an Operator the permission to proceed with RBI assessment for each facility and is not the final approval required for RBI implementation. In order to implement RBI for any facility based on the approval-in-

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principle, a comprehensive RBI assessment workshop shall be conducted for that particular facility. Multiple facilities may be assessed in a given workshop by an operator subject to concurrence by the Department. The assessment shall cover ALL the equipment/devices in the facility under the scope for which an approval is sought. Baseline inspections shall be conducted and documented for new facilities or facilities without appropriate inspection data, prior to the commencement of RBI assessment. The following minimum requirement must be met for a risk analysis to be accepted.

- i. The risk analysis process must be clearly documented in a written procedure. This procedure must be a referenced and controlled document under Owner-User quality manual.
- ii. Detailed definition of the procedure must be given throughout the risk analysis process. The procedure must detail how failure mechanisms are defined for each equipment and how likelihood and consequences of failure are established, and how this can be used to determine level and inspection frequencies.

The operator shall subject risk assessment procedure for audit and review by the DPR whenever there are major changes or every five (5) years, whichever comes first.

#### **3.4.1 Pre-Workshop Information**

At the minimum, the following data/information and documentation of all equipment/devices to be assessed shall be available prior to the commencement of any RBI assessment:

- i. Equipment technical and engineering specification(s)
- ii. Equipment identification information (equipment description, serial number, tag number, etc.)
- iii. As-built/Up-to-date Piping & Instrumentation Diagram, Process Flow
- iv. Diagram, etc. for the facility

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- v. Equipment inspection history (Baseline inspection for new facility)
- vi. Process Fluid description and characteristics
- vii. Observed external and surrounding(s) condition of the facility

### 3.4.2 Personnel Composition

- i. At the minimum, personnel experienced in operations, maintenance, inspection, corrosion specialist, HSE and process disciplines that are familiar with the equipment/devices under review shall be present.
- ii. DPR representative(s) shall be present at any RBI assessment workshop to fully participate and ensure adherence to the statutory and technical requirements.
- iii. All personnel participating in the RBI assessment shall be fully trained in the program to understand the implication of the contributions and decisions made. The training shall be documented and produced on demand.
- iv. The lead facilitator shall possess requisite certifications in and demonstrable knowledge of applicable Industry Codes and Standards such as API 510, 570, 571, 576, 580, 581, 653 and/or any other internationally recognized certifications on inspections, with a minimum of five (5) years cognate working experience in the discipline (RBI).

### 3.4.3 Baseline Inspections

Baseline inspections shall be conducted and documented for new facilities or facilities without appropriate inspection data, prior to the commencement of RBI assessment. This inspection shall be performed by a qualified third-party body/company in the presence of DPR representative(s) who shall witness and participate in the baseline inspection data field gathering and other related activities.

### 3.4.4 RBI ASSESSMENT RESULT

- i. The RBI assessment method, processes and assumptions approved in principle by the DPR shall be strictly followed during the assessment to arrive at the Maximum

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Inspection Interval (MII) for each piece of equipment/device under review. The inspection to be performed at this interval shall be major, internal and/or performance of tests/recertification for each equipment/device as applicable.

- ii. The results containing the information in Table 3.1 for each of the assessed equipment/device shall be submitted to the DPR in both hard and soft copies (Microsoft Excel format) at the end of the RBI assessment for approval.

Table 3.1: RBI Assessment Results Submission Format

S/N	Elements	Notes
1	Submission Date	
2	Facility Name	Full Facility name
3	Equipment Type	Pressure Vessel, Pressure Relief Devices, etc
4	Equipment Description	E.G. Scrubber, Pilot Operated Valve
5	Equipment Serial Number	
6	Equipment Tag Number	
7	Equipment Manufacturer	
8	Equipment Installation Date	
9	Last Inspection Date	
10	Last NDT Inspection Type Performed	NST Inspection Type performed (Magnetic Particle Testing (MT); Radiographic Testing (RT); Ultrasonic Testing (UT) Etc)
11	Likelihood of Failure Ranking	Equipment Criticality Ranking
12	Consequence of Failure Ranking	Equipment Criticality Ranking
13	RBI Assessment Date	The date equipment/ device was RBI-assessed
14	Maximum Inspection Interval	
15	Next Inspection Date	Last Inspection Date + Maximum Interval
16	Proposed NDT Inspection Type	NST Inspection Type performed (Magnetic Particle Testing (MT); Radiographic Testing (RT); Ultrasonic Testing (UT) Etc)

Table 3.1: RBI Assessment Results Submission

### 3.5 RBI Approvals

After a satisfactory outcome of the RBI assessment and upon the submission of the RBI results, the DPR shall validate and issue a final RBI implementation approval for the assessed equipment/devices of a facility under review.

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Two (2) levels of approvals are therefore required to be obtained before the implementation of RBI on any equipment/device: Approval-in-principle to apply RBI methodology and Final Approval to implement RBI on a facility following a successful assessment for that particular facility. Any facility for which a **FINAL RBI** approval is yet to be obtained, shall be regarded as being operated under the prescriptive inspection regime in line with MOSR and other applicable legislation(s).

#### **4. RBI IMPLEMENTATION REQUIREMENTS**

##### **4.1 RBI Methodology**

After RBI approval has been obtained, the following shall be applicable:

- i. The RBI methodology and program approval issued to an Operator shall be reviewed within a maximum of five (5) years from the last review or whenever a change/review of the methodology is made; whichever comes first.
- ii. Owner-user audit and upgrade/update carried out on the RBI too shall be validated by the Department.
- iii. The application of an Approved RBI methodology principles by an operator shall be consistent for all RBI assessments conducted for equipment/facility.
- iv. Any contractor or third-party involvement in the RBI process must be subjected to the relevant procedure(s) and methodology. The inspection and maintenance management including roles, responsibilities and competencies must be defined to the satisfaction of the Department.

##### **4.2 RBI Validation**

- i. All assessed equipment shall be inspected within their respective Maximum Inspection Intervals.
- ii. Any submitted RBI assessment results (as per 3.4.4 (ii)) shall ALWAYS be kept and maintained at the respective facility locations and made available to DPR

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officers/inspectors on demand. Failure to do so shall be considered a non-compliance.

- iii. Any deviation or non-conformance (i.e. to exceed the Maximum Inspection Intervals) due to technical/operational constraints shall be documented in line with the approved procedure(s) and assented to by the Operator's management.
- iv. Any inspection deviation or non-conformance for any equipment/device with a criticality ranking above MEDIUM as per the obtained RBI risk assessment results, shall be submitted to the Department with justification for review and approval.
- v. RBI reassessment shall be conducted for any RBI-assessed facility within a maximum of five (5) years from the last assessment/reassessment or whenever there is a change or modification of the facility; whichever comes first.
- vi. After any RBI reassessment, the results shall be submitted to the Department in line with Section 3.4.4 (ii).

### **4.3 RBI Annual Reports**

Annual report for a preceding year shall be submitted to the Department by the third (3rd) week of every January in both hard and soft copies (Microsoft Excel) with the following details:

- a. The inspections performed (facility-wise) for all equipment/devices due within the reporting year. The inspection report shall contain the following;
  - i. Equipment/Device Description
  - ii. Equipment/Device serial number
  - iii. Equipment/Device tag number
  - iv. Inspection Date
  - v. Inspection Type
  - vi. Summary Inspection result
  - vii. Next Inspection Date



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b. **ALL** deviations and non-conformances recorded within the reporting year. The report shall contain the following;

- i. Equipment/Device Description
- ii. Equipment/Device serial number
- iii. Equipment/Device tag number
- iv. Actual inspection date
- v. Deviation/Non-conformance Approval Authority (Designation)
- vi. Basis for inspection deviation and non-conformance
- vii. Mitigation measures carried out to manage deviations
- viii. Proposed new inspection date.

c. The schedule/plan of inspections to be performed (facility-wise) for all equipment/devices due in the following year. The report shall contain the following;

- i. Equipment/Device Description
- ii. Equipment/Device serial number
- iii. Equipment/Device tag number
- iv. Proposed Inspection Date
- v. Proposed Inspection Type

## 5. PENALTIES

Failure to comply with any part of the provisions of this Guidelines for the Implementation of RBI in the Nigerian Oil and Gas Industry shall lead to the following:

- i. Enforcement of the applicable provisions for offences listed in the latest version of the MOSR and other relevant legislations; or

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- ii. Withdrawal of RBI approval, thereby, applying the default Prescriptive Provisions for Inspections contained in the latest version of the MOSR and other relevant legislations; or
- iii. Enforcement of both 5(i) and 5(ii).

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## 6. GLOSSARY

**AC**– Acceptance Criteria

**API RP** – American Petroleum Institute Recommended Practice

**MII** – Maximum Inspection Interval


**MOSR** – Mineral Oils (Safety) Regulations, 1963

**NID** – Next Inspection Date

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## 7. REFERENCES

- I. Regulation Concerning Implementation and use of Risk Analysis in the Petroleum activities with guidelines NORWEGIAN PETROLEUM DIRECTORATE 1990.
- II. ABSA Risk Based Inspection for Pressure Equipment Revision 0, 2001.
- III. API RP 580 - Risk Based Inspection Methodology
- IV. API RP 581 - Risk Based Inspection Technology
- V. API RP 572 – Inspection Practices for Pressure Vessels.

Approved by		
<p><b>Engr. Sarki Auwalu, MNSE</b>  (Director/CEO, Department of Petroleum Resources)</p>		
	<p>Date</p>	<p>1<sup>st</sup> August 2020</p>